Table 1 Th- and U-series radioactivity in some products of Sakurajima Volcano (10^{-13} Ci g^{-1})

Sample	Th-series (from ^{228}Ac and ^{208}Tl)	U-series (from ^{214}Bi)	U-series / Th-series
Pumice, 30 October 1975; andesite*	6.7 ± 0.8	1.84 ± 0.61	0.28 ± 0.09
'Ash', 30 October 1975; andesite*	5.7 ± 0.2	3.8 ± 0.2	0.67 ± 0.04
Lava, 1914; andesite	5.7 ± 0.2	4.4 ± 0.3	0.77 ± 0.06
Lava, 1776; andesite	8.5 ± 0.7	5.6 ± 0.5	0.66 ± 0.08
Pumice, Moeshima; dacite	5.7 ± 0.2	3.8 ± 0.2	0.67 ± 0.04

*Measurements were made within a few days of their fall.

amount in equilibrium with the parent, ^{226}Ra, and is expected to show its transient deficiency for several days after the event. This could explain the lowering of the U- to Th-series ratio observed for the pumice (Table 1). The ratio is, therefore, regarded as being indicative of the ^{226}Ra–^{222}Rn disequilibrium.

In subsequent eruptive activities (a detailed account will be published later), the volcano ejected, on 13 May 1976, a considerable amount of pumice. Figure 1 shows U- to Th-series radioactivity ratios for this material, and shows that the U- to Th-series ratio of the 1976 pumice was again significantly lowered for several days after the eruption, then increased to a value close to those of earlier lavas (Table 1).

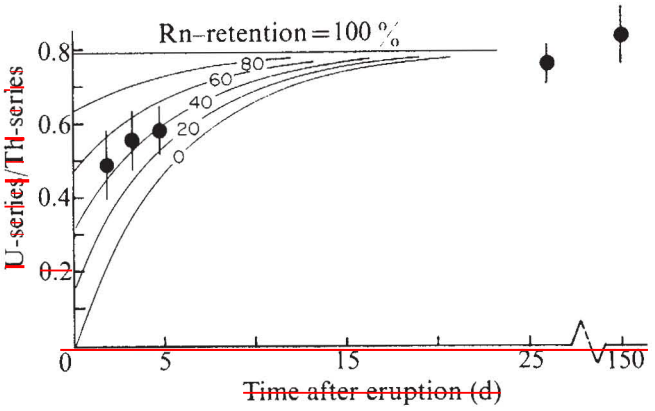

Fig. 1 Growth of U- to Th-series radioactivity ratio observed for the 1976 pumice from Sakurajima. Growth curves are based on the assumption that a ^{226}Ra–^{222}Rn equilibrium was established in the magma before the eruption. The values are plotted against the mid-points of counting times.

The disequilibrium observed above may also be due to radon release at the moment of eruption. If a ^{226}Ra–^{222}Rn equilibrium is assumed to have been established in the magma before the eruption, the growth of ^{222}Rn in the pumice should indicate its re-establishment. The data are expected to fit a growth curve derived from two parameters: (1) the observed U- to Th-series activity ratio of pumice at the equilibrium and (2) the percentage of unreleased radon in the erupting magma. In Fig. 1 are shown the growth curves for postulated values of (2), and, on this basis, the data correspond to a 50–60% release of radon.

The behaviour of radon in an erupting magma may be different from that of major volatiles. It would be possible, however, to characterise explosive eruptions by extending the method presented here to other fresh pyroclastic materials.

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Effects of inbreeding on cognitive performance

THE few studies[1,2] in which the effects of inbreeding on cognitive performance have been examined revealed that offspring of first-cousin marriages had lower IQ scores than offspring of unrelated parents. These studies were, however, performed in societies where the population engaging in such marriages is a small (1%, 6%)[2,3] and unrepresentative proportion of the total population. Possible confounding of the effects of inbreeding with the effects of other intelligence-related variables such as socioeconomic status may lead the effects of inbreeding to be overestimated[2]. Unfortunately statistical control may either over- or under-correct for the correlates of the independent variables, leaving one in doubt about the true effect of inbreeding. I have now examined the effects of inbreeding on cognitive performance in an Arab population with a high rate of consanguinous marriage which minimised the distortions due to non-genetic variables. I show here that offspring of unrelated parents performed better than offspring of first-cousin marriages in intelligence and achievement tests administered at grades 4 and 6. The lowest level of performance and a higher variance were found for offspring of double-cousin marriages. The inbreeding depression found in this study is consistent and cannot be explained by the effects of socioeconomic status. I drew a nationally representative sample of 3,203 children in grades four and six (approximate ages 10 and 12 yr) of the Arab educational system in Israel. This sample constitutes about 10% of the total population in these grades and includes only normal (not retarded) children. Column 1 in Table 1 shows the division of the subjects according to grade level and consanguinity of the parents. A first-cousin marriage is between children of siblings. Children of first cousins have, on average, 1/16 pairs of genes by common descent. Double first cousins are children of siblings married to unrelated siblings. When they marry, their children have, on the average, 2/16 pairs of genes by common descent.

A study of Arab education in Israel revealed that the frequency of consanguinous marriages in the Arab population is about 34%. The Arab community encourages such marriages and therefore the group that intermarries should be a representative sample of the population. Double first-cousin marriages are hardly known in Western Society but

exist to a significant degree (about 4%) in my sample population. Their popularity is no doubt partly explained by economic considerations concerning the custom of 'bride price'. When a brother and sister of one family marry a brother and sister of another, there is no need for the groom to pay the bridal price.

It is reasonable to assume that other consanguineous marriages—between, for example, second and third cousins—exist in our sample. However, only three alternatives were given to the question on blood relationships (unrelated, cousins and double cousins) and, consequently other consanguineous marriages were probably classified by the respondents as one of the two latter categories, especially first cousin marriages. This would tend to make the real inbreeding coefficients somewhat lower than the above coefficients (1/8, 1/16). We can also assume that, since prolonged inbreeding increases the coefficient of inbreeding[5], the inbreeding coefficient of the control group is not zero. But prolonged inbreeding has also occurred for the inbred groups, so it is safe to assume that there exists an increasing order of the degree of inbreeding, from the control group (of outbred children) to the first cousins' offspring and to the double cousins' offspring.

Table 1 Consanguinity and socioeconomic status of subjects

	Number of subjects	Father's education (mean yr)	Mean SES†
Grade 4			
First cousins	503	5.6	9.7
Double first cousins	71	5.1	9.1
Others (unrelated)*	1,054	5.2	9.4
Total sample	1,628	5.3	9.5
Grade 6			
First cousins	467	5.4	9.5
Double first cousins	54	5.0	9.1
Others (unrelated)*	1,054	5.0	9.4
Total sample	1,575	5.1	9.4

*In a population with a high rate of consanguinous marriages the so-called 'unrelated' group probably does not have a zero inbreeding coefficient (see text).
†Socioeconomic status.

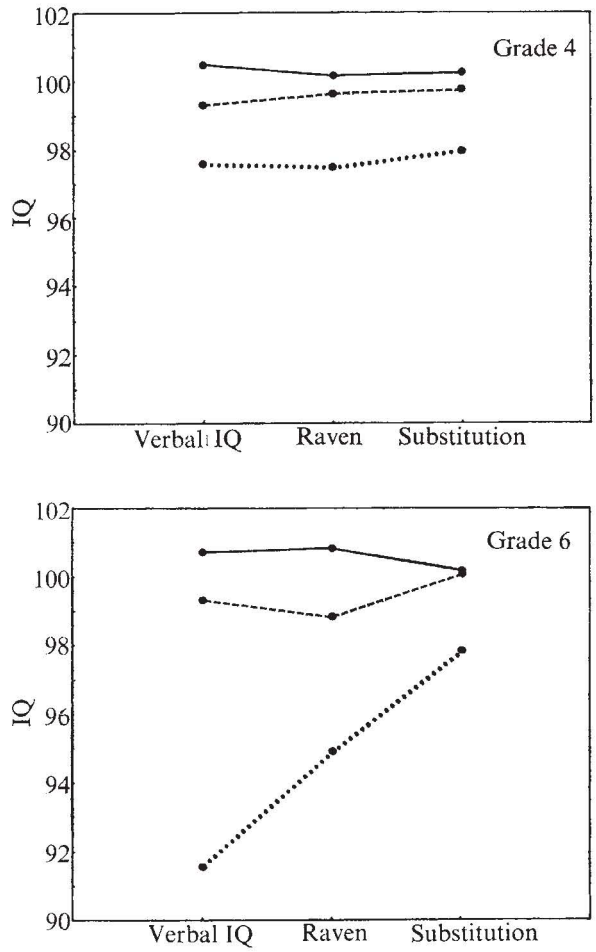

Fig. 1 Mean IQ scores on the three mental ability tests to parental consaguinity, for grades 4 and 6. ——Not related, – – – cousins, ... double cousins.

Socio-economic status (SES) of the groups was defined as an index of the following four components: (1) father's plus mother's level of education; (2) father's profession; (3) room density; and (4) physical home conditions. Each of the four components was divided into four graded categories. SES was defined as the sum of these four components, thus ranging from four to sixteen, with each of the four components being of equal weight. Table 1 shows that unrelated parents have somewhat lower SES than the first cousins. The double first cousins have lower SES than the unrelated group but the difference is less than 0.1 s.d. As the very small differences in SES favour the first cousins as compared with the other two groups, any reduction in performance found in the inbred groups cannot be explained by differences in SES.

Three mental ability tests and four achievement tests were used. As the genetic component is assumed to be larger in informal learning (ability tests) than in specific knowledge formally taught in the classroom (achievement tests) I expected inbreeding to have a smaller effect on performance in achievement tests than in ability tests. The mental ability tests included (1)*a*, a verbal general knowledge and comprehension test and *b*, a verbal test to find the 'odd one out'. Both tests were equally weighted to construct a single verbal IQ score. (Alpha reliability coefficient is 0.93, correlations averaging 0.70 with achievement tests and teacher's evaluation.) (2) A shortened version of Raven's Progressive Matrices[6] was used to measure nonverbal ability. (3) A substitution test that, unlike the other two, was given under a strict time limit and was used to measure associative learning. The four achievement tests were constructed in accordance with the specific school curricula of each grade (Arabic, Hebrew, mathematics and science). The alpha reliability coefficients range from 0.80 to 0.91 and the correlations between the four tests average about 0.70. All tests were administered to groups of children and given simultaneously in all the sample classes.

Table 2 presents the mean scores and standard deviations for the mental ability and achievement tests, according to grade and parental consanguinity. Figure 1 shows the IQ scores on the three mental ability tests for the different consanguinity groups, separately for each grade. Figure 2 shows the *t* scores of achievement tests (with a mean of 50 and s.d. of 10 for each test).

All the results follow the expected pattern and the order of performance level of the three groups is consistent. Outbred children achieved the highest level of performance and offspring of double cousin marriages achieved the lowest. Thus, an inbreeding depression is suggested in both grades and in all the tests.

The results in Table 2 show a tendency towards higher variance in the double cousin group. This is the case in 13 out of the 16 possible comparisons; the result is statistically significant in five of the comparisons, all of which are in grade 6 (general knowledge, finding the odd one out, Arabic, Hebrew and science).

The inbreeding depression shown in Table 2 and Figs 1 and 2 is too modest to warrant changes in educational policy, but the consistency of the effect for the different tests in both grades strengthens the argument that its cause is indeed genetic. Surprisingly, there was no difference between performance in achievement and ability tests: inbreeding

Table 2 Mean scores and standard deviations of mental ability and achievement tests according to parental consanguinity and grade level

Grade	Parental consanguinity	Mental ability tests: Verbal ability: General knowledge (51)* Mean	s.d.	Finding odd-one-out (25)* Mean	s.d.	Raven's Matrices (28)* Mean	s.d.	Substitution (144)* Mean	s.d.	Achievement tests: Arabic (58/57)† Mean	s.d.	Hebrew (51/51)† Mean	s.d.	Mathematics (39/40)† Mean	s.d.	Science (29/30)† Mean	s.d.
4	'Unrelated'	32.2	8.3	12.8	5.6	8.8	5.1	53.5	24.4	37.1	11.9	21.8	7.8	21.2	7.9	14.7	5.1
	First cousins	31.5	8.9	12.3	5.8	8.6	5.1	52.7	28.2	36.3	12.0	21.3	7.9	20.8	8.4	13.5	5.3
	Double first cousins	31.0	9.3	11.4	5.9	7.9	5.1	49.6	23.7	34.4	12.9	21.1	8.1	20.1	8.9	13.3	5.3
6	'Unrelated'	38.4	8.3	16.4	5.9	13.1	6.1	70.5	27.0	37.9	10.6	31.4	10.2	18.6	8.7	17.6	5.7
	First cousins	37.6	8.2	15.8	6.1	12.3	6.2	70.4	27.0	37.4	10.7	30.4	10.3	18.3	8.5	17.3	5.7
	Double first cousins	33.0	12.0	13.0	7.3	10.6	6.7	65.8	27.0	32.0	13.2	27.7	12.4	16.9	10.0	15.2	7.1

*Number of items in the test.
†The left-hand numbers represent the number of items in the test for grade 4 and the right-hand numbers, number of items for grade 6.

depression seems clear and consistent in both. It is interesting that the effect is smaller for the mathematics and substitution tests, though the three groups fall into the same order here as for the other tests.

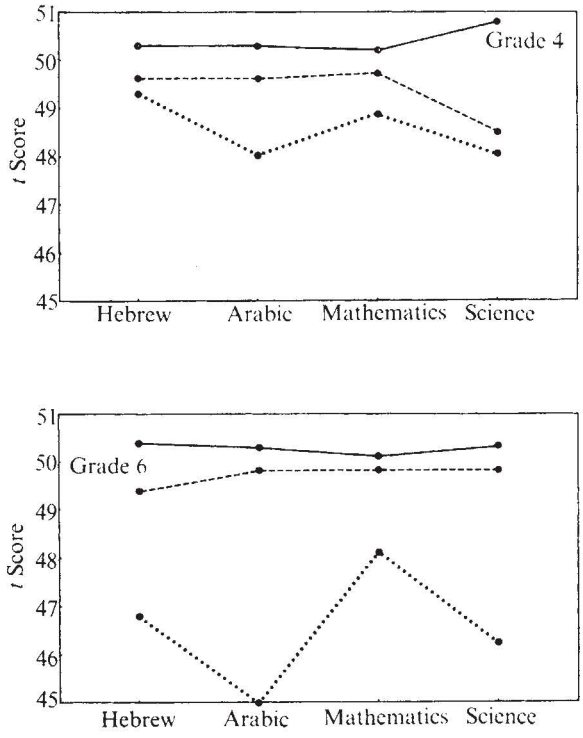

Fig. 2 Standardised means (*t* scores) of achievement tests according to parental consanguinity for grades 4 and 6. ——, Not related; – – –, cousins; . . . ., double cousins,

The inbreeding depression clearly demonstrates the importance of a genetic component in the variance of cognitive performance in this population. This could result either from the general increase in homozygosity that results from inbreeding or from decrease in performance resulting from homozygosity for specific recessive alleles[7,8]. The higher variance of the double cousin group in some of the tests favours the second interpretation.

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The significance of the nose for certain phenomena of visual perception

BOWER[1] draws attention to the fact that the majority of organisms have evolved in such a way that part of the body (almost invariably the nose) is permanently present in the visual field. This, as he points out, can hardly be accidental and indicates that the organ may have a function in visual perception; subjects lacking a nose may differ from normals on tests of visual capacity. Unfortunately this clinical condition is now rarely encountered and affected individuals may, in any case, develop compensatory techniques, for example, reliance on glimpses of some other part of the body. It may be more profitable to consider the effects of making the nose visible where this is not normally the case. The autokinetic phenomenon may, for example, be a consequence of the fact that in total darkness the nose is invisible and cannot play its customary role as a stable point of reference by which other objects in the visual field are judged stationary or in motion with respect to the observer. What would be the effect of making the nose visible? I report here two experiments in which the nose was visible in an otherwise dark visual field. Contrary to Bower, autokinetic movement seems to have persisted.

The autokinetic phenomenon occurs when a subject fixates a point source of light in an otherwise dark field. The light characteristically appears to move, though it is in fact stationary throughout. Recent experimental work has vastly increased our understanding of the parameters governing the extent of this phenomenon, but none of the proposed explanations has survived experimental test. Bower's proposal implicating the nose is prima facie appealing but has not been confirmed empirically. What is required is a means of making the nose visible to the subject in an otherwise dark visual field since movement should not then be reported. Two alternative methods suggest themselves. The subject may wear a luminous false nose, or small electric light bulbs may be inserted in his nostrils illuminating the nose from within. Each method has disadvantages. The luminous false nose has a pale greenish-white appearance and does not correspond in size and conformation to the subject's own nose (being usually somewhat larger). The inserted light bulbs involve a degree of physical discomfort but the organ visible is the subject's own, even though translucent pink in colour. Both methods were used in the two experiments to be reported. The